The U.S. house price boom 2000-2006 in a Heuristics Switching DSGE Model

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Background

- The literature has identified at least four factors as important sources of the U.S. housing boom 2000-2006:

    1) Loose monetary policy (Taylor, 2008)

    2) A relaxation of borrowing constraints (Mian and Sufi, 2009, Boz and Mendoza, 2010)

    3) A global saving glut (Bernanke, 2005)

    4) Deviations of house prices from fundamentals (Shiller, 2007)

- However, the DSGE literature has mainly relied on large and persistent shocks to housing preferences to explain the house price boom (Ferrero, 2015, Justiniano et. al., 2013, Gete, 2013)

- Main problem: Preference shocks do not produce a boom in the price-to-rent ratio as observed in the data

- Many observers have for many years stressed that fundamentals can not account for house prices dynamics (Case and Shiller, 2003, Glaeser and Nathanson, 2014)

What I do

- Set up a standard two-country DSGE model with housing and borrowing constraints where domestic consumers borrow from ROW due to relative impatience ($\beta < \beta^*$) (Ferrero, 2015)

- Replace rational expectations with simple heuristics
  - Agents can choose between two simple rules to forecast future variables
  - Selection mechanism similar to Brock and Hommes, 1997): Agents continuously switch between rules to minimize their (past) mean squared forecasting error

- Three exogenous shocks:

    1) **Loose domestic monetary policy**

    -> identified as deviations of the FFR from a standard Taylor rule from 2000-2006

    2) **A relaxation of borrowing constraints**

    -> identified as an increase in the LTV ratio from 90 pct. to almost 100 pct. from 2000-2006 (Duca et. al., 2011)

    3) **A saving glut**

    -> identified as an increase in the foreign discount factor that produces a decline in the domestic nominal interest rate of roughly 160 basis points (Bernanke et. al., 2011)

Expectations

- **Fundamental rule:**

$$E_{fun,t}\hat{x}_{t+1} = 0$$

  – expected deviation from steady state is zero

- **Extrapolative rule:**

$$E_{ext,t}\left[\hat{x}_{t+1} - \hat{x}_{t-1}\right] = \beta_{ext}\left[\hat{x}_{t-1} - \hat{x}_{t-3}\right]$$

  – past changes in a given variable – multiplied by a factor, β_{ext} - is extrapolated into the future
  – motivated by the survey evidence of Case, Shiller and Thompson (2012) (CST)
  – CST estimates β_{ext} to 0.23

- Share of agents that choose each rule (Brock and Hommes, 1997):

$$\alpha_{fun,t}^{x} = \frac{exp\left(-\gamma U_{fun,t}^{x}\right)}{exp\left(-\gamma U_{ext,t}^{x}\right) + exp\left(-\gamma U_{fun,t}^{x}\right)} = 1 - \alpha_{ext,t}^{x}$$

  – where $U_{fun,t}^{x}$ is a weighted average of mean-squared forecasting errors of the fundamental rule and γ is the "intensity of choice" (I work with $\gamma=1$, close to the estimates in Anufriev et. al., 2013)

RESULTS:
Loose monetary policy and "Bretton Woods II"

- Expansionary monetary policy lowers the real interest rate, which increases borrowing and raises house prices.
- Amplified by exchange rate pegs in saving glut countries
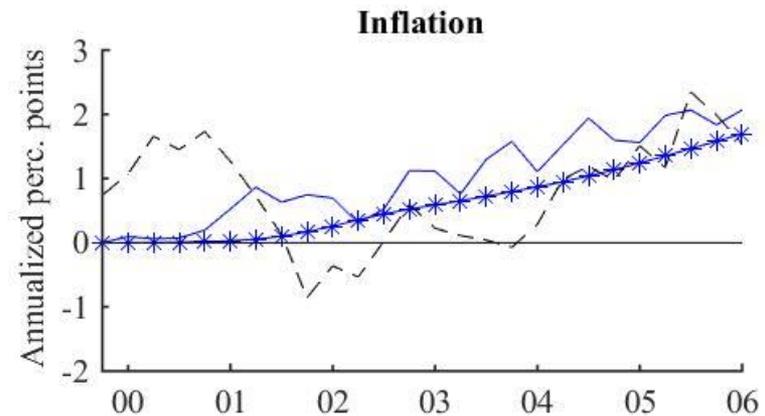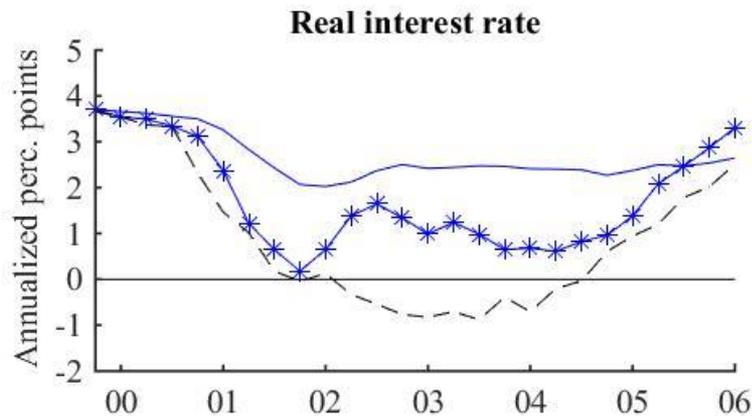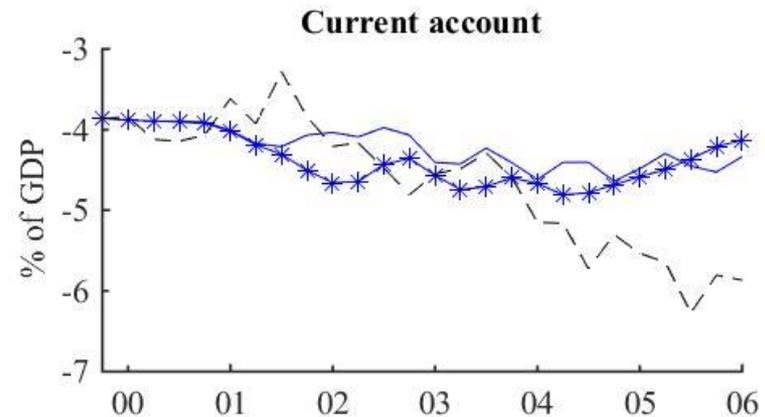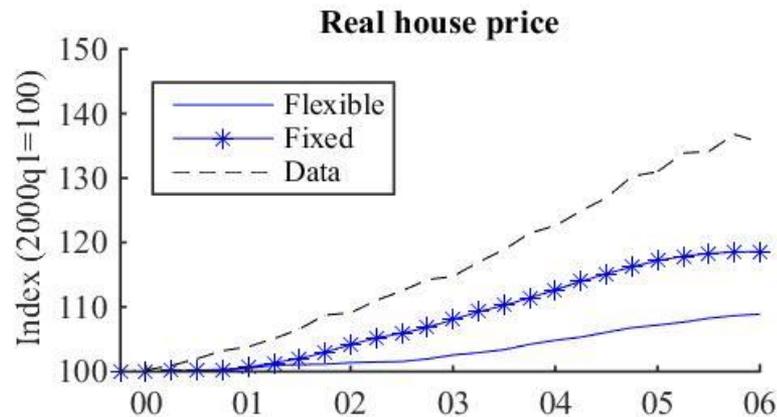
Expectations formation

- The initial distribution of "extrapolators"/"fundamentalists" is 50/50
- Agents quickly switch to the extrapolative rule, except for inflation:
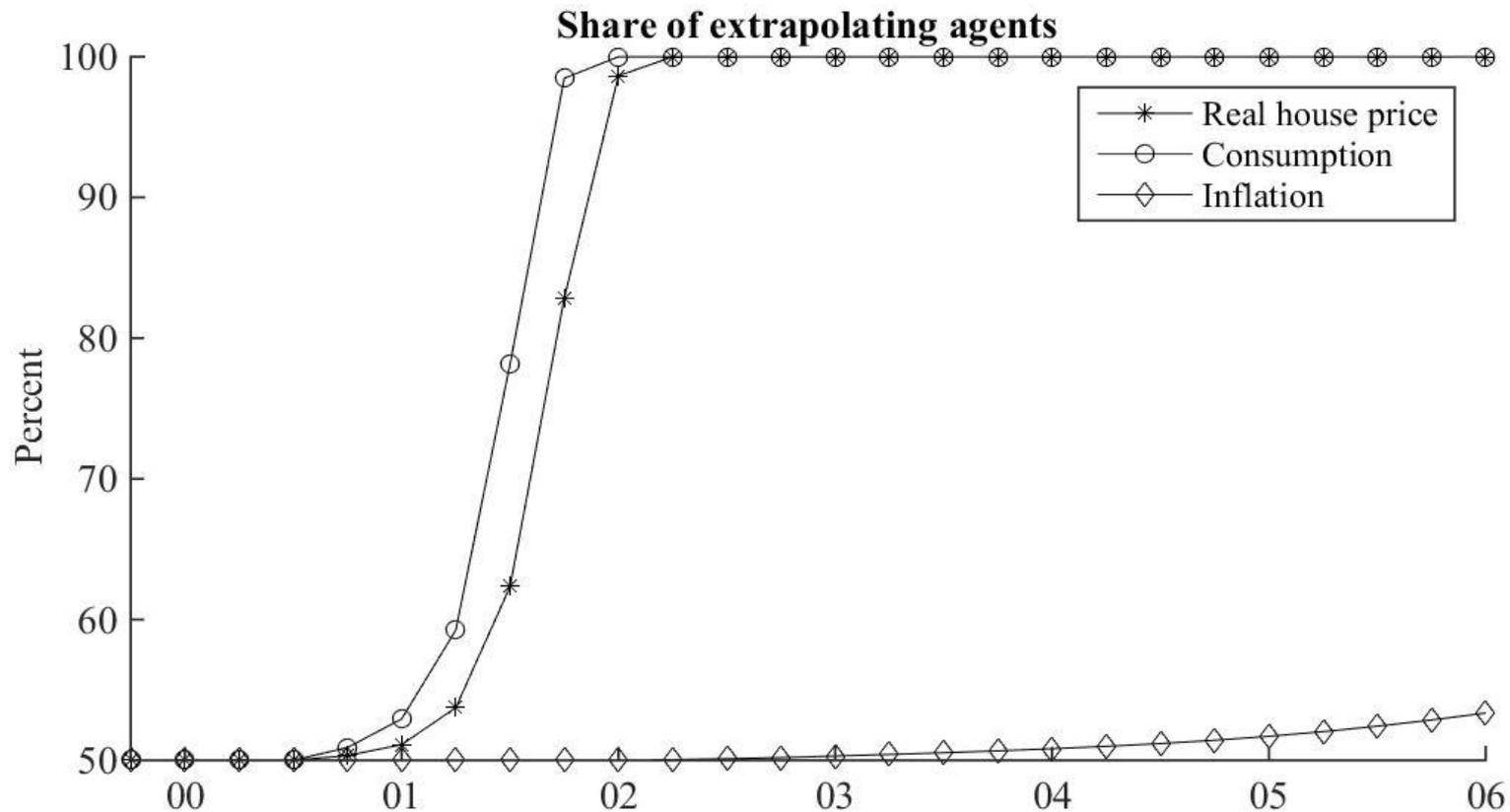
RESULTS (II): Global saving glut

- An exogenous capital inflow lowers the real interest rate, which further increases borrowing and raises house prices:
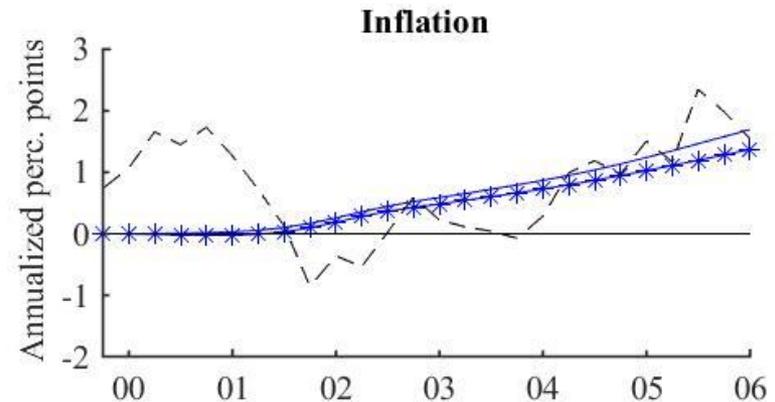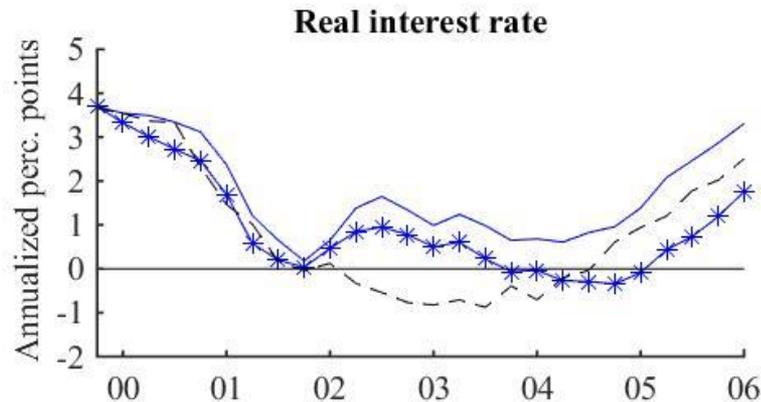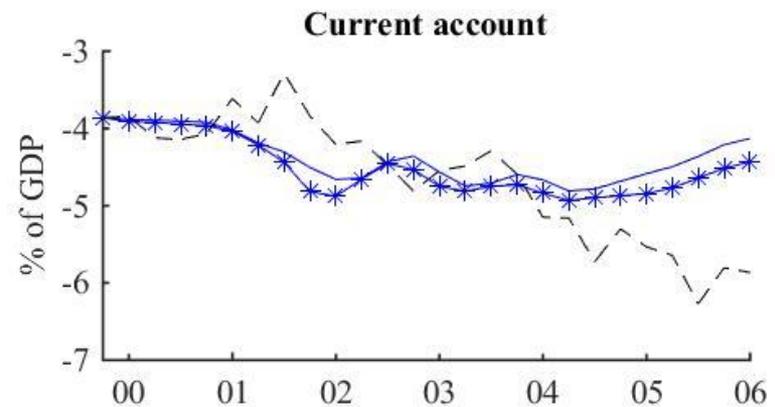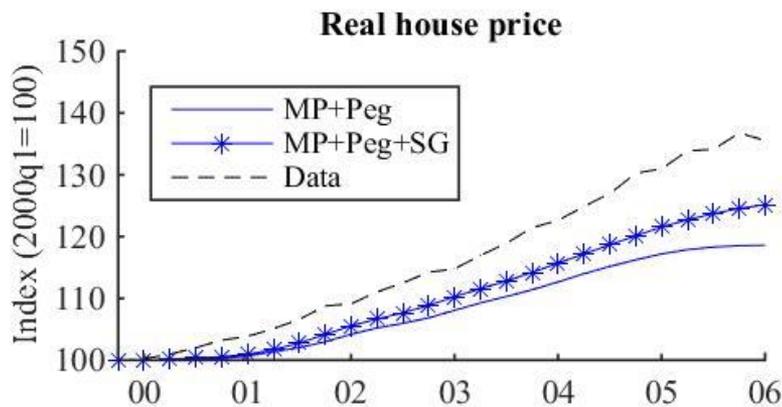
RESULTS (III):
# Relaxation of borrowing constraints

- An increase in the LTV ratio further increases debt and house prices
- The behavioral model can almost fully account for the house price boom and the low real interest rate and for more than half of the current account deterioration. Moreover, it can account for the gradual increase in inflation 2002-2006.
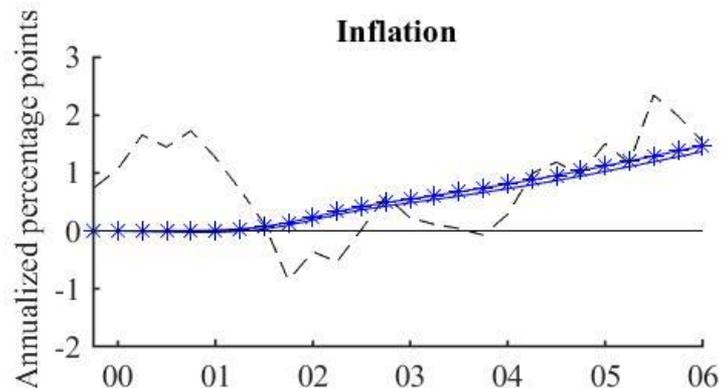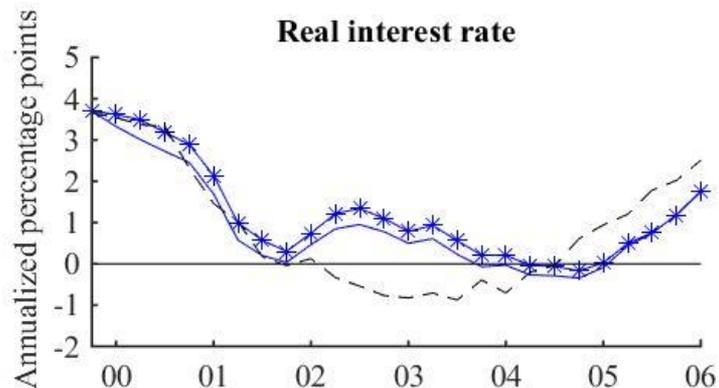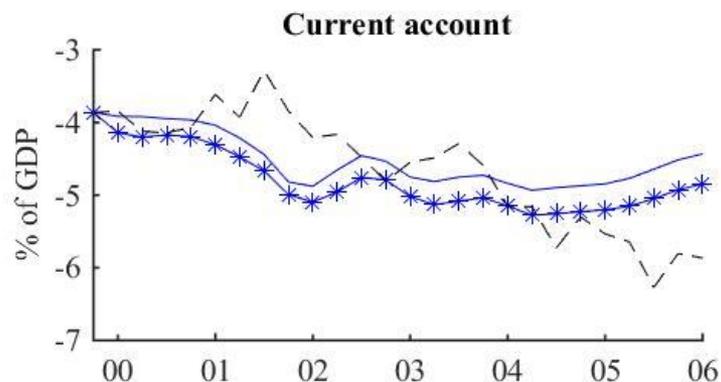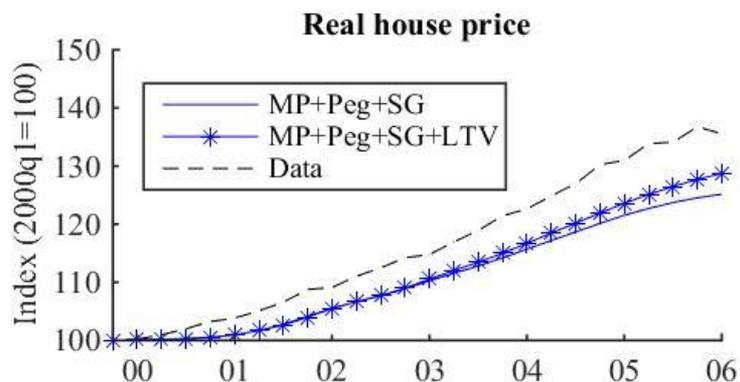
Heuristics vs. rational expectations

- A similar model with rational expectations can reproduce around half of the house price boom if the home discount factor is low (around $\beta = 0.90$)
- The boom is almost solely driven by LTV shocks
- However, for empirically plausible values of the discount factor ($\beta = 0.96$), , the house price boom collapses and the collateral constraint seizes to bind:
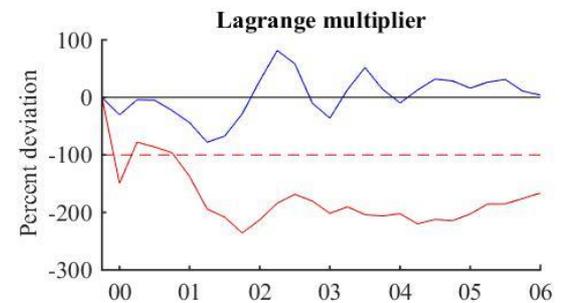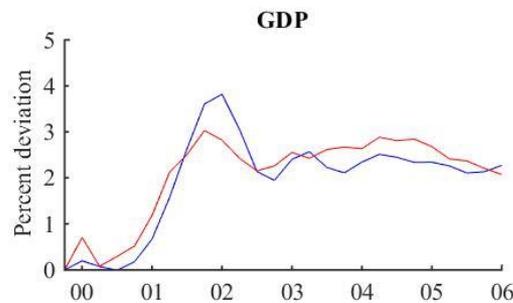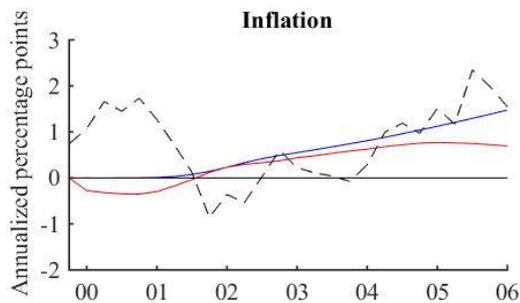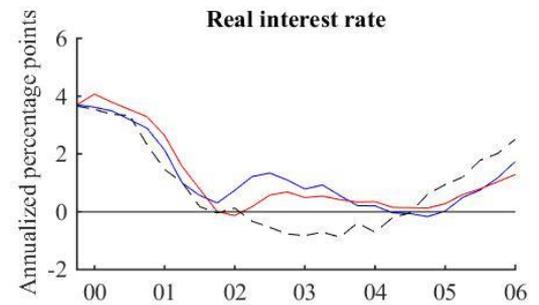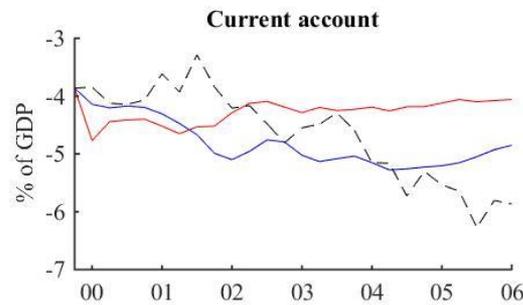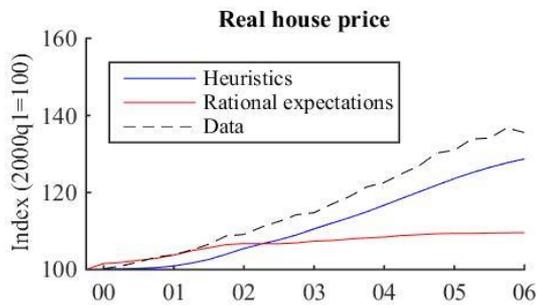
Should monetary policy respond to house price appreciation?

- Rational expectations: <u>NO</u>
  - Strong deflation and ZLB
- Heuristics Switching: <u>YES</u>
 - An augmented Taylor rule with a positive response to house prices enables the central bank to stabilize both inflation and output and largely prevent the house price boom and the deterioration of the current account:
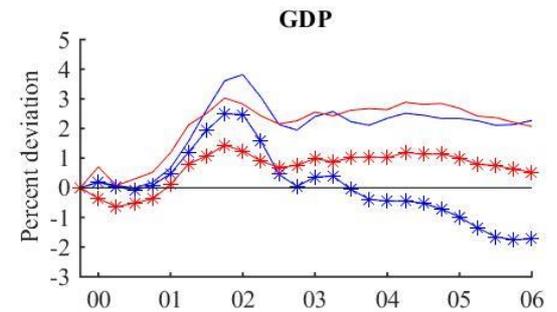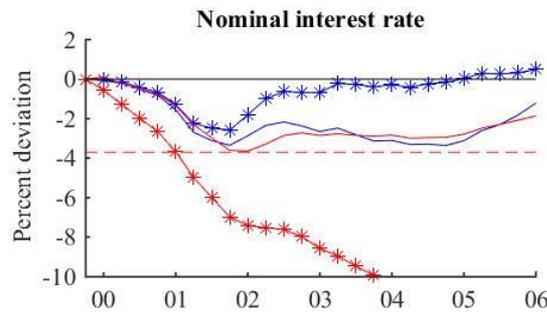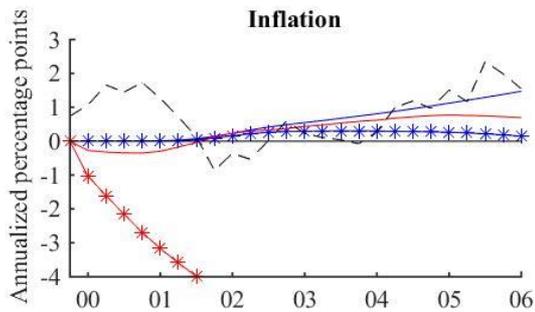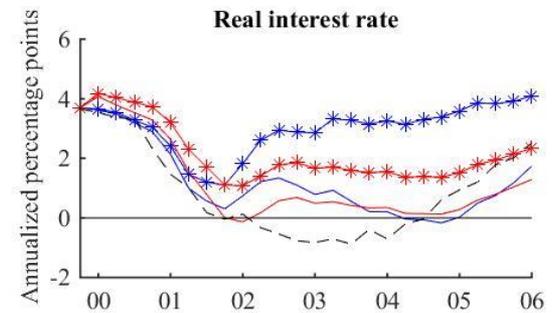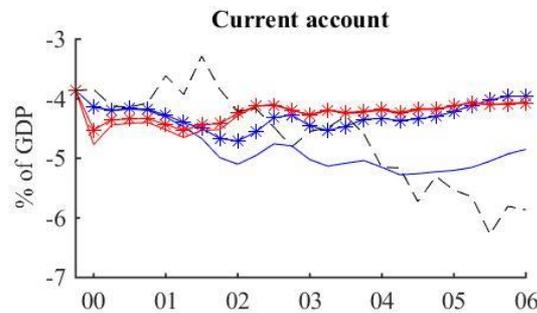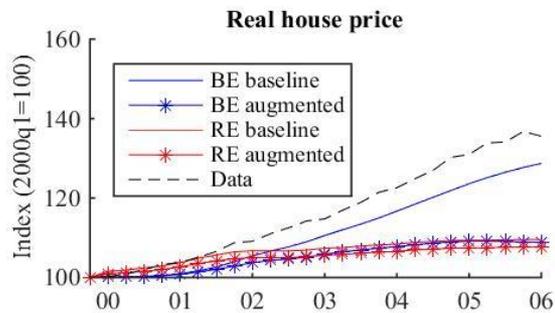
References

- Anufriev, M., Bao, T., and Tuinstra, J. (2013): "Fund Choice Behavior and Estimation of Switching Models: An Experiment". *Working paper*
- Bernanke, B. (2005) "The Global Saving Glut and the U.S. Current Account Deficit". *Remarks at The Homer Jones Lecture*, St. Louis, MO.
- Bernanke, B., Bertaut, C., DeMarco, L. P., Kamin, S. (2011) "International Capital Flows and the Return to Safe Assets in the United States, 2003-2007". *Board of Governors of the Federal Reserve System International Finance Discussion Papers Number 1014,* February 2011
- Boz, E. and Mendoza, E. G. (2010) "Financial Innovation, the Discovery of Risk, and the U.S. Credit Crisis". *NBER Working Paper* no. 16020.
- Brock, W. A. and Hommes, C. H., 1997, "A Rational Route to Randomness", *Econometrica* 65 (5), 1059-1096
- Case, K. E. and Shiller, R. J. (2003) "Is there a bubble in the housing market?", *Brookings Papers on Economic Activity*, 2003, no. 2
- Case, K. E., Shiller, R. J. and Thompson, A. K. (2012): What Have They Been Thinking? Homebuyer Behavior in Hot and Cold Markets, *Brookings Papers on Economic Activity*, p. 265-298
- Duca, J., Muellbauer, J. and Murphy, A. (2011) "Shifting Credit Standards and the Boom and Bust in U.S. House Prices". *SERC Discussion Paper no. 76*
- Ferrero, A. (2015) "House Price Booms, Current Account Deficits, and Low Interest Rates". *Journal of Money, Credit and Banking*, Suppl. to Vol. 47, No. 1 (March-April 2015)
- Gete, P. (2013) "Housing Demand and Current Account Dynamics". *Mimeo*, Georgetown University.
- Glaeser, E. L. and Nathanson, C. G. (2014): "Housing Bubbles", *NBER Working Paper* 20426.
- Justiniano, A., Primiceri G., Tambalotti, A. (2013) "Household Leveraging and Deleveraging". *NBER Working Paper* No. 18941.
- Mian, A. and Sufi, A. (2009) "The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis". *Quarterly Journal of Economics*, 124(4), pp. 1449-1496
- Shiller, R.J. (2007) "Understanding Recent Trends in House Prices and Homeownership". *Proceedings*, Federal Reserve Bank of Kansas City: 89-123.
- Taylor, J. B. (2008) "The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong". *A Festschrift in Honour of David Dodge*, pp. 1-18. Bank of Canada